earth sciences

Tektites and magnetic reversals

A number of researchers have noted that some microscopic marine fauna became extinct and others suddenly appeared at times when the earth's magnetic field was reversing polarity (SN: 11/21/70, p. 392).

It now is proposed that these extinctions and geomagnetic reversals may share a common cause. The clue lies in tektites—rounded glassy particles of unknown origin.

Epochs of normal and reversed polarity are sometimes interrupted by brief periods when the polarity is opposite to the dominant polarity of the epoch.

Drs. S. A. Durrani and H. A. Khan of the University of Birmingham in England have established ages of microtektites from sediments adjacent to a tektite field on the Ivory Coast, and they believe that the Ivory Coast microtektites correspond to the last such interruption, about 0.9 million years ago. (Previous studies of microtektites from Australia showed that those tektites coincided in age with the beginning of the present magnetic epoch.)

It has been suggested that tektites are the result of a comet striking the earth. It is possible, Drs. Durrani and Khan suggest in the July 30 NATURE that such an impact could cause a magnetic reversal as well. If tektites are produced by cometary impacts, then gases such as frozen ammonia and methane from cometary nuclei might have appreciable ecological effects when introduced rapidly into the atmosphere and oceans. Some organisms thrive on these substances; others might find them lethal.

Sea level variations

The level of the ocean changes in response to a number of nontidal factors, such as melting glaciers, lowering of seawater density resulting from summer warming, and changes in annual river runoff.

Drs. Robert H. Meade of the U.S. Geological Survey and K. O. Emery of Woods Hole Oceanographic Institution charted sea level variations along the Atlantic and Gulf of Mexico coasts of the United States from tide-gauge records for 1931 to 1969.

During the period studied, the average annual sea level shows a general rise that can be attributed to melting glaciers and regional crustal deformation, they report in the July 30 SCIENCE.

Comparing sea level variations with data on river runoff for the same period, they find that the proportion of total variation in sea level that can be attributed to river runoff ranges from 7 to 21 percent. Subtracting the amount due to glacial melting and deformation, they conclude that a tenth to a half of the total variation must be due to such factors as wind, water temperature, currents and atmospheric pressure.

Continental Divide seismic network

One of the requirements for obtaining a better underunderstanding of earthquakes is a seismic network that detects all the earth's groans and shifts (SN: 2/20/71, p. 131). A number of regional networks are already in operation in various parts of the world.

Now the Colorado School of Mines and the National Oceanic and Atmospheric Administration are installing a network of 15 seismic sensing stations straddling the Continental Divide in Colorado. The stations, 13 of which are already operating, are arranged in two loops, one in the Denver metropolitan area and the other extending from Vernal, Utah, to Trinidad, Colo.

The network is expected to detect more than 200 local shocks during its first year of operation. It records earthquakes of Richter magnitude 2.5 or more.

NOAA researchers will use data from the network to study the structure and dynamics of the solid earth and to develop an improved system for rapidly locating earthquake hypocenters (actual fracture sites). CSM will be studying short-term recurrence patterns of earthquakes in Colorado.

Opening of the northeast Atlantic

The evolution of the Pacific, Indian and South Atlantic ocean basins have been outlined in some detail from studies of magnetic lineations. Relatively little interpretive work has been done for the North Atlantic, partly because the lineations in that area are hard to identify.

Drs. C. A. Williams and Dan McKenzie of Cambridge University collected and combined magnetic data from several sources. The North Atlantic began to open in the late Triassic (230 million to 180 million years ago) when North America and Africa separated. Then the spreading ridge between the continents grew northward into the Bay of Biscay. By 80 million years ago, the part of the ridge extending into the bay had ceased to be active and the main ridge had extended in another direction—northwest toward the Labrador Sea.

The older lineations show a bent structure, running northeasterly south of Biscay and bending northwesterly off Biscay's mouth. There are two possible explanations for this structure, the researchers say in the July 16 NATURE. Either the spreading was assymetric or the ridge had once had a number of small offsets, so that it was, in effect, bent.

Refining the Mediterranean fit

Though geologists are generally agreed that the continents were once joined together in a single mass, they are still undecided about exactly how the pieces fit together and how they evolved to their present shapes and positions. One area of uncertainty is the Mediterranean.

Dr. A. Gilbert Smith of Sedgwick Museum in Cambridge, England, has made a preliminary geometric fit of the continental fragments around the Mediterranean that extends previous reassemblies to the Balearic Islands, Corsica, Sardinia, Italy, Yugoslavia, Greece and Turkey. The fit, he says, in the August GEOLOGICAL SOCIETY OF AMERICA BULLETIN, applies to Permo-Triassic time (about 230 million years ago).

Dr. Smith's reconstruction shows a large gap between southern Eurasia, Turkey and Greece that he believes shows the probable shape of the now-extinct Tethys Sea.

In the opening of the Mediterranean, he says, there were at least three phases. Relative to Eurasia, Africa moved eastward in lower Jurassic to early Upper Cretaceous time (about 170 million to 60 million years ago), then westward until about 37 million years ago, when it began its present-day northward movement.